**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, D.C. 20554**

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| In the Matter of | |
| Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band | WT Docket No. 08-166 |
| Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition | WT Docket No. 08-167 |
| Amendment of Parts 15, 74, and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones | ET Docket No. 10-24 |

# REPLY COMMENTS OF DELL INC. AND MICROSOFT CORP.

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## I. INTRODUCTION AND SUMMARY.

Dell and Microsoft agree with the National Broadband Plan's goal of advancing unlicensed technologies in general, and unlicensed white spaces broadband technologies in particular. As the Plan explains, unlicensed spectrum policies yield numerous benefits, "including low barriers to entry and faster time to market, that have reduced costs of entry, spurred innovation and enabled very efficient spectrum usage."[1] Accordingly, the Plan calls for the FCC to free up spectrum "for use exclusively or predominantly by unlicensed devices" and to "complete the final rules for TV white space devices in order to accelerate the introduction of new innovative products and services."[2]

Maximizing the consumer benefit of the television bands by taking into account both innovative wireless broadband devices and currently unauthorized wireless microphones is critical to achieving these goals. As the *Further Notice* recognizes, the FCC should ensure that "spectrum is used efficiently and effectively by wireless microphones," which will "increase spectrum availability for other uses, including the continued development of wireless broadband."[3] In its opening comments, Dell and Microsoft suggested that, to strike the appropriate balance between television band uses, the FCC should: (1) promote the use of more efficient wireless microphone technologies; (2) to the extent that it seeks to legalize currently unauthorized microphones, do so by permitting unlicensed Part 15 operation of these devices; (3) eliminate the sensing

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1 Connecting America, the National Broadband Plan at 95, available at http://download.broadband.gov/plan/national-broadband-plan.pdf.

2 *Id*. at 94-95.

3 *Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band; Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones*, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24, Report and Order and Further Notice of Proposed Rulemaking ¶ 146 (rel. Jan. 15, 2010) ("Further Notice" or "FNPRM").

requirement for white space devices and require new Part 15 TV band microphones to use the same operating parameters as white space devices to the maximum extent possible; and (4) not expand the Part 74 licensing regime because this would unnecessarily make white space operations infeasible in many areas, and because expansion of Part 74 is simply not necessary to accommodate wireless microphone users.[4]

Comments by public interest organizations and technology companies support these recommendations. In contrast, microphone manufactures ask the Commission to reward them for years of marketing and sales practices that flout the FCC's rules by licensing currently unauthorized operations. Manufacturers provide no explanation for how this proposal would balance the Commission's twin goals of finding a path forward for microphone users and ensuring that all spectrum is used as "effectively and efficiently as possible."[5]

## II. THE COMMISSION SHOULD PROMOTE SPECTRALLY EFFICIENT WIRELESS MICROPHONES.

### A. Wireless Microphone Manufacturers Should Not Be Exempt From the Commission's Efforts to Facilitate More Efficient Spectrum Use.

There is no dispute that, as the *Further Notice* recognizes, wireless microphone operations often "result in inefficient use of valuable spectrum."[6] Because this inefficiency comes at a huge cost to other innovative spectrum uses, the comments of public interest organizations, technology companies, and wireless carriers urge the

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4 *See generally* Comments of Dell Inc. and Microsoft Corp. (filed Mar. 1, 2010) ("Dell/Microsoft Comments").

5 *See* FNPRM ¶ 4.

6 FNRPM ¶ 147.

Commission to take steps to ensure that microphones operate more efficiently.[7] In contrast, the largest manufacturer of TV band wireless microphone systems – which use wideband frequency modulation techniques developed during the Great Depression – makes the jaw-dropping assertion that wireless microphones are "incompatible with the Commission's goal of improving spectral efficiency" through use of digital modulation.[8] This is wrong as a matter of science and spectrum policy.

According to some microphone manufacturers, there is "no suitable alternative" to existing analog wideband FM technology for many microphone applications.[9] However, actual wireless microphone users do not share this myopic view. In fact, the Coalition of Wireless Microphone Users has already indicated that "[a]ny equipment introduced by manufacturers that would increase the efficiency of spectrum use at a reasonable price without sacrificing audio quality would find a ready market."[10]

Wireless microphone manufacturers maintain that digital microphones should not be used in live performance environments, which cannot tolerate "more than a few milliseconds of delay."[11] This is a red herring. As Adaptrum already has explained, alleged concerns about digital delay have not stopped live performances from using other

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7 *See, e.g.*, Comments of the Media Access Project, New America Foundation and Public Knowledge (Public Interest Spectrum Coalition) (filed Mar. 1, 2010) at 3-7 ("PISC Comments"); Dell/Microsoft Comments at 3-6; Comments of CTIA - The Wireless Association® (filed Mar. 1, 2010) at 5-6 ("CTIA Comments"); Comments of Motorola Inc. (filed Mar. 1, 2010) at 4-5 ("Motorola Comments"); Comments of Spectrum Bridge Inc. (filed Mar. 1, 2010) at 2-3 ("Spectrum Bridge Comments"); Letter from Hai Yun Tang, Ph.D., Adaptrum Inc., to Marlene Dortch, Secretary, FCC (filed Mar. 5, 2010) at 1-2 ("Adaptrum *Ex Parte*").

8 Comments of Shure Incorporated (filed Mar. 1, 2010) at iv ("Shure Comments").

9 *See, e.g.*, Shure Comments at 4.

10 Comments of the Coalition of Wireless Microphone Users (filed Mar. 1, 2010) at 11 ("CWMU Comments").

11 Shure Comments at 27; *see also* Comments of Sennheiser Electronic Corporation (filed Mar. 1, 2010) at 11 ("Sennheiser Comments").

digital audio technologies, such as digital mixers, which would introduce the same delay microphone manufacturers claim is unsuitable for live events.[12] Furthermore, advances in digital technology already have resulted in products that meet or exceed the performance threshold manufacturers claim is necessary for live events. These low-latency digital microphones are already in the market today. For example, the Lectrosonics D4 wireless system has an overall latency of less than 1 millisecond for a system with digital input and digital output.[13] Similarly, Sony's DWT-B01 digital wireless transmitter has an audio delay of only 1.5 milliseconds.[14] And Line 6's digital wireless microphone systems, which use the ISM bands rather than television spectrum, already are used by artists on tour.[15]

Finally, one manufacturer makes the mistaken assertion that digital modulation is somehow *less* efficient than analog FM wideband.[16] This argument is wrong because it presupposes that digital transmission would not take advantage of encoding techniques to transmit data more efficiently — unlike virtually every other high quality digital signal used today. Of course, this would not be the case. For example, the Apt-X Live digital audio codec, which is specifically designed to accommodate digital wireless microphone use in live events, "can deliver a single channel of 24 bit, 48 kHz audio at 144 kbps and a

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12 Adaptrum *Ex Parte* at 1.

13 *See* D4: Digital Wireless System, Instruction Manual at 17, http://www.gnarlywireless.com/lectrosonicsweb/manuals/D4systemMan.pdf.

14 *See* Sony: Digital Wireless Microphone System, http://pro.sony.com/bbsccms/assets/files/cat/audio/brochures/Digital_Wireless_Mics_Brochure_final2-09.pdf at 12.

15 *See* Line 6, Digital Wireless, Artists, http://line6.com/wireless-microphone/artists.html.

16 *See* Shure Comments at 28-29.

codec latency of less than 1.9 ms" while also enabling "significantly higher density of channels" compared with analog wideband.[17]

### B. Co-channel Microphone Operations, Apparently Accepted by Broadcasters, Should be Made Legal.

The Commission can also improve the spectral efficiency of wireless microphones by legitimizing the apparent practice of wireless microphones operating in occupied broadcast channels where the parties coordinate their operations. This point was amply illustrated during the second phase of white spaces field testing performed by the Office of Engineering and Technology in 2008. On two separate occasions, in midtown Manhattan and at FedEx Field in Landover, MD, wireless microphone operators improperly transmitted on the same channels as occupied television stations *while in the presence of FCC engineers*.[18] In fact, one of the channels used by wireless microphones at FedEx Field was the very channel used to carry the high definition broadcast of the football game taking place that day.[19]

When representatives from one of the technology companies present at the testing asked a wireless microphone operator about this situation, the operator suggested that these co-channel transmissions had been "coordinated."[20] Co-channel transmissions are not permitted even if the operator has a valid Part 74 license,[21] but this apparently widespread practice suggests that the Commission should consider this option. By

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17 Apt-X Live, White Paper, http://www.aptx.com/Documents/apt-X-Live---Application-Note-for-Digital-Wireless.aspx.

18 Letter from Edmond Thomas, Senior Technology Policy Advisor, White Spaces Coalition, to Marlene Dortch, Secretary, FCC (filed Aug 19, 2008).

19 *Id*. at 2.

20 *Id*. at 1.

21 47 C.F.R. § 74.802(b).

allowing broadcasters and wireless microphone operators to share the same spectrum, the Commission will make more spectrum available for wireless microphones without adversely impacting other uses of the TV bands.

## III. GRANTING UNAUTHORIZED MICROPHONES PART 74 BROADCAST LICENSES WILL UNDERMINE WIRELESS BROADBAND AND PERPETUATE INEFFICIENT SPECTRUM USE.

As Dell and Microsoft explained in their opening comments, extending Part 74 to cover currently unauthorized microphones will undermine the Commission's commitment to promoting wireless broadband access.[22] Even a modest expansion of Part 74 will result in portions of major markets where white space use will be foreclosed.[23] In addition, the National Broadband Plan has recommended reallocating 120 megahertz from broadcast spectrum to meet growing demand for wireless broadband.[24] Increasing licensed narrowband analog use of this same spectrum will greatly complicate these efforts. Fortunately, expanding Part 74 is completely unnecessary given the other options available to users of unauthorized devices.[25]

The record demonstrates that these facts are not the only reason the FCC should not expand Part 74. The FCC's rejection of Part 74 expansion is the right course of action because: (1) Microphone manufacturers assert that Part 74 cannot be expanded in a limited way; (2) Part 74 expansion will undermine database operations; and (3) Part 74 expansion will undermine incentives for a transition to more spectrum efficient wireless microphones.

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22 Dell/Microsoft Comments at 12-14.

23 *Id*. at 11-12.

24 National Broadband Plan § 5.8.5 at 88-93.

25 Dell/Microsoft Comments at 12-14.

### A. Wireless Manufacturers Argue that Part 74 Cannot be Expanded In a Limited Way.

As the *Further Notice* recognizes, expanding Part 74 so that "virtually anyone would be eligible for a license" would cripple wireless broadband.[26] Some commenters argue that the Commission could, however, expand Part 74 to include only a smaller sub-set of currently unauthorized users. These commenters suggest that the FCC could reduce the negative impact of currently illegal microphones on wireless broadband by basing expanded Part 74 eligibility on the number of wireless microphones used by a licensee, the size of the potential audience for a licensees performance, or the range of microphones required.[27]

Unfortunately, microphone manufacturers state that such a limited expansion is nearly impossible. Even Shure admits that such distinctions are unworkable because "number of seats or dimensions within a facility do not necessarily correlate to the extent and nature of wireless audio use."[28] Shure also contends that "wireless audio … cannot easily be reduced to a specific purpose," and, therefore, any attempt to "'adopt a 'bright line' test for license eligibility … will impose arbitrary cut offs, generate questionable results requiring additional interpretation, and be quickly rendered obsolete by usage and technology trends."[29]

Instead, Shure proposes practically unlimited new classes of Part 74 licensees, with the only litmus being whether "audio is an integral part of the performance or

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[26] *See* FNPRM ¶ 134.

[27] CWMU Comments at 9; Motorola Comments at 6.

[28] Shure Comments at 8.

[29] Shure Comments at 3, 7.

presentation."[30] Sennheiser makes an analogous demand, asking that any facility with fixed seating and either "an audio amplification system or an occupancy of 50 or more" be entitled to a license.[31] Similarly, Audio-Technica suggests that those eligible for a license under Part 90 – that is, virtually anyone – should also be eligible under Part 74.[32] Some manufacturers even go so far as to suggest that microphone rental companies that "serve a wide variety of users … who require wireless audio for many different functions" should be eligible for Part 74 licenses themselves.[33] In other words, these proponents of Part 74 expansion urge the very result that the Commission already cautioned "may not be viable" if the public is also to realize the benefits of white spaces.[34]

Fortunately, the FCC need not try to draw the line between entities that would and would not be eligible for the expanded Part 74 license. As Dell, Microsoft, and the Public Interest Spectrum Coalition explain, by allowing currently unauthorized microphone users to operate under Part 15, the Commission can ensure that current and future microphone users can operate in the TV band without the need to judge which users deserve a license and which do not.

Finally, Shure continues to suggest that the Commission is to blame for the current state of affairs that necessitated this proceeding because its rules have "not kept

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30 Shure Comments at 6.

31 Sennheiser Comments at 5.

32 Comments of Audio-Technica U.S., Inc. (filed Mar. 1, 2010) at 12 ("Audio-Technica Comments").

33 Shure Comments at 11. *See also* Sennheiser Comments at 6 (advocating expansion for rental companies but noting that the license should be valid "only for otherwise qualifying venues").

34 FNPRM ¶ 134.

pace" with unauthorized uses encouraged by the marketing of Shure and others.[35] The White Spaces Coalition and Public Interest Spectrum Coalition already addressed these arguments in detail in 2008, and Dell and Microsoft incorporate them by reference here.[36] However, the Commission should be troubled by Shure's continuing refusal *even to acknowledge* the central role it played in bringing about these unauthorized operations, much less the ongoing investigation surrounding its conduct. The Commission's consideration of how to proceed in this docket should reflect the uniquely widespread rule violations manufacturers' business practices have caused.

### B. Part 74 Expansion Would Impede Database Operations.

As the *Further Notice* recognizes, Part 74 expansion also could "increase the number of Part 74 licensees submitting information for inclusion in the TV Band Device database, thus increasing the cost and complexity of operating the database."[37] Audio Technica maintains that "the Commission and white spaces device manufacturers should be less concerned with the number of licensed users and more concerned with ensuring that the licensing database is properly and professionally managed."[38] But as one database administrator candidate has explained, "accommodating a substantial Part 74 expansion will dramatically increase the amount of data that must be processed and synchronized across databases, significantly driving up operating costs and, ultimately, the cost of white space access."[39]

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35 *See* Shure Comments at 3.

36 *See, e.g.*, Reply Comments of the White Spaces Coalition, WT Docket Nos. 08-166, 08-167 (filed Oct. 20, 2008) at 1-12; Reply Comments of the Public Interest Spectrum Coalition, WT Docket Nos. 08-166, 08-167 (filed Oct. 20, 2008) at 7-12.

37 FNPRM ¶ 134.

38 Audio-Technica Comments at 14.

39 Spectrum Bridge Comments at 4.

Even if this were not the case, Audio Technica is wrong to suggest that the Commission should not concern itself with the number of Part 74 licensees in the database. Perhaps the best illustration of the burden additional licensees could impose comes from Shure, which suggests that "users may be motivated to 'block out' groups of frequencies that *they might or might not use*" if those users do not find the ultimate database rules to their liking.[40] This result is clearly contrary to the Commission's objectives in the white spaces proceeding, as well as its broader goal of improving spectral efficiency. The better answer is to grant currently unauthorized microphones co-equal Part 15 status in the TV band.

### C. Increasing Protections for Unauthorized Microphones Will Remove Incentives to Transition to More Efficient Technologies.

The record in this proceeding confirms that there are many high fidelity options to accommodate wireless microphone operations short of expanding Part 74.[41] For example, digital modulation techniques allow high fidelity uses of this spectrum in the ISM bands.[42] Similarly, Audio Technica continues to highlight its advances in ultra wideband microphone technology.[43] Finally, certain uses highlighted in this proceeding already are eligible for Part 74 licenses under existing rules. For example, the American Federation of Television and Radio Artists notes that broadcast journalists need

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40 Shure Comments at 13 (emphasis added).

41 *See, e.g.*, PISC Comments at 5-6; Dell/Microsoft Comments at 12-14; Spectrum Bridge Comments at 4; Comments of the Association for Maximum Service Television, Inc. and the National Association of Broadcasters (filed Mar. 1, 2010) at 5-6 ("MSTV Comments").

42 Dell/Microsoft Comments at 13.

43 Audio-Technica Comments at 3-4.

interference free wireless microphones to provide news and emergency broadcasts – activities that are already Part 74 low power auxiliary activities.[44]

Moreover, most unauthorized wireless microphone uses identified in this proceeding simply do not require equipment that meets the technical performance characteristics identified by manufacturers in this proceeding. As one wireless microphone manufacturer has confirmed, there are a "multitude of applications where premium professional audio quality is not needed [including] religious services, educational institutions, sporting events, business seminars, etc."[45] These uses should be accommodated outside of the TV bands.

These alternatives mean that the Commission should work to incent microphone manufacturers to make more responsible, spectrum-efficient devices – not grant Part 74 status and cement the use of inefficient technologies for another generation. Such an expansion of the amount of TV band spectrum available for exclusive use by microphones would remove a critical incentive for manufacturers to make their products more efficient. For example, Sennheiser has explained that, "[a]s more wireless microphones are deployed in a fixed amount of spectrum, not only will manufacturers come under pressure to improve spectrum efficiency, but the market will evolve to cover the costs."[46] Similarly, CTIA recommends that any new wireless microphone authorizations occur only in the lower portions of the TV bands to "promote the migration to digital technology … and help to align the necessary incentives to create an

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[44] Comments of the American Federation of Television and Radio Artists (filed Mar. 1, 2010) at 2.

[45] Audio-Technica Comments at 12, n.5.

[46] Sennheiser Comments at 12.

environment ripe for innovative and efficient spectrum use."[47] For this reason, the Commission not only should decline to expand Part 74, but also should not reserve *additional* channels beyond the 12 MHz of spectrum wireless microphones can use exclusively in thirteen of the largest U.S. markets.[48]

## IV. NEW WIRELESS MICROPHONES CERTIFIED FOR TV BAND USE UNDER PART 15 SHOULD FOLLOW PART 15 TV BAND RULES.

The *Further Notice* has concluded that, "from a power and spectrum sharing standpoint, one type of [Part 15 TV band] device should not have a significant advantage over the other."[49] Similarly, PISC has stressed that additional wireless microphones authorized as a result of its petition should not be done in a way that would "creat[e] seniority against properly authorized devices."[50] To realize this goal, the Commission must eliminate the sensing requirement for white space devices, and ensure that, going forward, Part 15 TV band microphones use the same operating parameters as white space devices to the maximum extent possible.

As Dell and Microsoft explained in opening comments, one of the most significant obstacles to ensuring that devices operate on a truly co-equal basis with other Part 15 devices in the TV band spectrum is the requirement that devices sense for Part 74 microphones.[51] This is because spectrum sensing cannot distinguish between Part 74 microphones (which are entitled to protection) and Part 15 microphones (which are not).

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47 CTIA® Comments at 6.

48 *See* CWMU Comments at 5; Motorola Comments at 2.

49 FNPRM ¶ 120.

50 PISC Comments at 7.

51 Dell/Microsoft Comments at 6-9.

Several commenters share this concern.[52] The Commission should remove the sensing requirement for wireless microphones, or at a minimum make sensing information an optional datapoint for white space devices rather than a means of restricting spectrum use.

Dell and Microsoft fully agree with those commenters that propose that new Part 15 wireless microphones comply with all the rules that apply to other Part 15 TV band devices, including geolocation capability, to the extent possible.[53] Wireless microphone manufacturers have objected that doing so will add costs and decrease battery performance.[54] However, the Commission already determined that the benefits of these rules outweigh financial and operation costs for commercial products by insisting that TV band devices include attributes like geolocation capability. If manufacturers of authorized white spaces devices can bear these costs, manufacturers of currently unauthorized microphones can also bear these costs.

More fundamentally, requiring all Part 15 TV band devices to operate under similar rules will lead to substantial benefits. First, as noted above, the National Broadband Plan concludes that 120 megahertz should be reallocated from television broadcasting for broadband use, including through "repacking" channel assignments.[55] As Dell and Microsoft have previously explained, mandating geolocation for microphones will greatly facilitate these efforts, since databases can be updated to reflect

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52 *See, e.g.*, PISC Comments at 8; Spectrum Bridge Comments at 4-5. *See also* Motorola Comments at 4 (urging elimination of sensing requirement).

53 *See, e.g.*, PISC Comments at 7-9; Motorola Comments at 4-5.

54 *See, e.g.*, Audio-Technica Comments at 6-7;

55 National Broadband Plan § 5.8.5 at 88-93.

reallocated spectrum that is no longer available for wireless microphone use.[56] In addition, mandating communication with databases will provide additional incentives for wireless microphone manufacturers to transition to digital systems, and allow microphones to take advantage of "value added" information in white spaces databases regarding the channels best suited to their operations at a given place and time.[57]

Finally, requiring new Part 15 "Wireless Audio Devices" to incorporate geolocation will also alleviate the primary concern of incumbent licensees – that these devices will cause interference to their operations. For example, MSTV suggests that expanding Part 15 for wireless microphones would result in a proliferation of "baby monitors, voice-controlled remote-controlled toys … and … household devices like home intercom systems and wireless door bells," and that these and other new Part 15 wireless audio devices would "inevitably" be used co-channel to broadcast operations. [58] To the extent the rules would allow such devices to be authorized as Wireless Audio Devices, a geolocation requirement would ensure that the devices operate only on authorized channels, just as it does for white space devices.

Similarly, requiring Wireless Audio Devices to operate under the white spaces rules would alleviate the concerns of the public safety community, which maintains public safety operations in the 470 – 512 MHz band in certain areas of the country.[59] As the National Public Safety Telecommunications Council has explained, "[u]nlike the

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56 *See* Dell/Microsoft Comments at 9 (citing Comments of Dell Inc. And Microsoft Corp. – NBP Public Notice # 26, GN Docket Nos. 09-47, 09-51, 09-137 at 7-8 (Dec. 21, 2009)).

57 Dell/Microsoft Comments at 9.

58 MSTV Comments at 7.

59 *See, e.g.*, Comments of the National Public Safety Telecommunications Council (filed Mar. 1, 2010) at 4 ("NPSTC Comments"); Comments of the Association of Public-Safety Communications Officials-International, Inc. (filed Mar. 1, 2010) at 2.

devices authorized in the Commission's TV whitespace proceeding, these unlicensed wireless microphones and low power wireless audio devices would have no intelligence to use geolocation techniques or query a database to avoid licensed [public safety] operations."[60]

The public safety community is correct to be concerned. After all, until called to the Commission's attention in the white spaces proceeding, Shure's "frequency finder" website actually *recommended* that its customers (legal or otherwise) operate in Washington DC using channels 16 and 17, which have 28 public safety licenses.[61] Requiring all new Part 15 devices certified for use in the TV bands to operate under the rules applicable to white space devices – particularly geolocation – is the best means of ensuring that these vital services are protected.[62]

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60 NPSTC Comments at 4.

61 Ex Parte Letter of Michael J. Marcus, Director, Marcus Spectrum Solutions, ET Docket No. 04-186 (filed May 5, 2008) at 5-6 (citing http://spectrumtalk.blogspot.com/2008/04/wireless-microphone-manufacturers.html).

62 *See* NPSTC Comments at 4.

## V. CONCLUSION.

Dell and Microsoft appreciate the difficult decisions the Commission must make as it addresses the unauthorized use of broadcast auxiliary microphones. By taking actions to ensure that microphones transition in the near term to more spectrally efficient options, both inside and outside the television bands, the Commission can ensure that the public has access both to innovative new broadband services and the use of wireless microphone systems.

Respectfully submitted,

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